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Self-Efficacy as a Mediator in the Relationship between Knowledge and the Practice of Applying Higher Order Thinking Skills (HOTS)

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Abstract

This study aims to determine the effect of self-efficacy as a mediator in the relationship between knowledge and the practice of implementing Higher-Order Thinking Skills (HOTS). The study involves Home Science teachers from 156 secondary schools in the central zone. The sample consists of 162 teachers, selected using simple random sampling. This study employs a quantitative approach, with a questionnaire distributed via a Google Form link. Data were analysed descriptively using Pearson correlation and multiple regression with IBM Statistical Package for Social Sciences (SPSS) 29.0. Overall, the variables yielded high results. The findings indicate a strong positive relationship between knowledge and the practice of implementing HOTS. Direct and indirect effects were observed through multiple regression analysis, identifying the mediation type as partial mediation. The results of this study can assist the Ministry of Education Malaysia (KPM), the State Education Department, and schools in organising professional development programs to enhance teachers' knowledge and self-efficacy, focusing on HOTS-based teaching strategies.

Keywords: Knowledge, Implementation Practice, Self-Efficacy, Higher-Order Thinking Skills (HOTS)

Introduction

In the ever-evolving educational landscape, Higher-Order Thinking Skills (HOTS) remain a priority in the Malaysian education system as a response to the rapidly developing 21st-century challenges (Ichsan et al., 2019; Mustika et al., 2020; Wijers & de Haan, 2020). In line with the Malaysia Education Blueprint 2013-2025, HOTS is integrated into the curriculum, pedagogy, and assessment to produce critical thinking and competent students who can compete globally. However, HOTS is important in mainstream education and technical and vocational education (TVET), which emphasises practical and technical skills. Consequently, HOTS and TVET are closely related, as both emphasise relevant 21st-century skills, such as problem-solving, critical thinking, and innovation. In other words, TVET aims to produce

competent and competitive workers through practical training that emphasises technical and vocational skills and creative thinking. HOTS also plays a vital role in helping students pursuing TVET to think analytically, solve real-world problems, and adapt to industry developments. This approach also emphasises supportive elements, such as teacher training, learning resources, and collaboration with the community and the private sector (Ministry of Education Malaysia, 2019). However, the effectiveness of HOTS implementation largely depends on teachers' knowledge and self-efficacy, which is their confidence in their ability to deliver effective teaching (Bandura, 1977). Teachers with high self-efficacy tend to use creative strategies that foster critical and creative thinking among students. Meanwhile, a lack of knowledge and confidence can affect the success of HOTS implementation.

To address the demands for change specified in the Malaysia Education Blueprint 2013-2025, *Kurikulum Standard Sekolah Menengah (KSSM)* was introduced to transform the national education system. The *Dokumen Standard Kurikulum dan Pentaksiran (DSKP)* serves as a comprehensive guide, emphasising content standards, learning standards, and performance standards. It supports 21st-century skills and HOTS and is based on six main pillars in the *Kurikulum Standard Sekolah Menengah (KSSM)* framework. It also fits with *Falsafah Pendidikan Negara*, which emphasises intellectual, spiritual, emotional, and physical growth. Teachers hold a vital role in incorporating HOTS elements to support students in thinking critically and creatively, equipping them to confront future challenges (DSKP, KSSM Home Science Form 4).

The Home Science subject offered in Forms 4 and 5 supports the curriculum transformation in the fields of Science, Technology, Engineering, and Mathematics (STEM). The curriculum caters to industry demands by prioritizing practical skills and competencies that garner national and international recognition. *Mata Pelajaran Elektif Ikhtisas (MPEI)* not only provides theoretical knowledge but also trains students to apply it practically to face the competitive global world. The development of these soft skills aims to produce individuals who are prepared to face the challenges of the 21st century, where the adaptation of technology and innovation is key to progress in the global arena.

Based on the analysis of SPM results, there was an increase in the *Gred Purata Mata Pelajaran (GPMP)* for Home Science from 5.16 in 2022 to 5.07 in 2023. However, the pass percentage has not yet reached 100%, and students' performance in answering HOTS questions shows a decline. As many as 84.6% of students received grades B+ or below in 2023, compared to 85.7% in the previous year (Ministry of Education Malaysia, 2022; Ministry of Education Malaysia, 2023). The shortage of specialised teachers and the students' weak academic backgrounds require teachers to use engaging and appropriate teaching methods to ensure the effectiveness of integrating HOTS elements.

To implement HOTS effectively, teachers need to have in-depth knowledge and adequate training (Mohammad et al., 2019; Hamzah et al., 2019). Studies show that teachers who understand HOTS elements are more likely to use them in teaching, but lack of preparation and negative attitudes toward curriculum changes pose obstacles (Andin, 2023). Additionally, the effectiveness of HOTS also depends on students' cooperation during the teaching and learning process. Teacher self-efficacy plays a crucial role in effectively implementing HOTS (Mohd Zaidi et al., 2021). According to Bandura (1986), an individual's

self-confidence influences how they act in challenging situations. Teachers with high confidence are more creative and efficient in their teaching (Ismail & Walid, 2018; Khan et al., 2020).

Still, a lot of teachers have trouble understanding the ideas and principles behind Higher-Order Thinking Skills (HOTS), which makes it harder for them to use these things in their lessons (Mohd Zhaffar et al., 2021). Insufficient pedagogical knowledge also impacts the application and assessment of HOTS components in the classroom (Zohar, 2013). Teachers also have a hard time implementing HOTS because they aren't prepared, they have too much work to do, and they must stick to a full curriculum (Omar & Hussin, 2020; Hassan et al., 2021).

The Pedagogical Content Knowledge (PCK) theory of Shulman (1987) emphasises that a teacher's knowledge encompasses both subject content and appropriate delivery methods to aid student understanding. This knowledge is crucial in the application of HOTS as it affects the quality of teaching and the effectiveness of the learning process (Huling, 2014; Jusoh & Osman, 2019; Ab Halim et al., 2021). Teachers with high confidence in their abilities tend to implement HOTS more effectively, which in turn enhances student achievement (Bandura, 1997; Dzul et al., 2021). Moreover, highly competent teachers in the implementation of HOTS can improve their teaching quality, thereby positively impacting students (Keong, 2020; Zaki et al., 2021).

Despite the abundance of studies on teachers' knowledge and self-efficacy, there is a dearth of research specifically focusing on Home Science teachers. Socio-cultural factors and the specific needs of this subject may influence teachers' approaches to the implementation of HOTS. Most research tends to focus on general aspects without considering the uniqueness of the Home Science subject and the teachers who teach it. There is a need to examine the relationship between knowledge, self-efficacy, and the practice of implementing HOTS among Home Science teachers. This study is important to understand how enhancing teachers' self-efficacy can support the more effective implementation of HOTS. The findings of this study can serve as a basis for developing professional development programs that help Home Science teachers achieve the educational goals outlined in PPPM 2013-2025. Thus, this study will address the following research questions:

1. What are the levels of knowledge, self-efficacy, and the practice of implementing HOTS among Home Science teachers?
2. Is there a relationship between knowledge and self-efficacy with the practice of implementing HOTS among Home Science teachers?
3. Does self-efficacy act as a mediator in the relationship between knowledge and the practice of implementing HOTS among Home Science teachers?

Literature Review

Higher-Order Thinking Skills (HOTS)

Higher-Order Thinking Skills (HOTS) refer to the challenge of using extensive thinking abilities when one needs to interpret, analyse, or manipulate information to answer questions (Newman, 1990). According to the Malaysian Examinations Board (2013), HOTS is defined as the ability to solve problems, make decisions, and create something new by using knowledge, skills, and reflection on a particular matter. Analytical, synthesis, creativity, and evaluation

skills involve the cognitive processes of generating and managing information. Thinking skills are one of the six essential characteristics students must have to reach their full potential and compete globally, as outlined in the Malaysia Education Blueprint (PPPM) 2013-2025 (Ministry of Education Malaysia, 2013). This is supported by Tanujaya et al. (2017), who states that besides HOTS, the national education transformation also focuses on equipping students with 21st-century skills to enable them to compete globally, proving that these students have high and broad marketability. Robbins (2014) mentions that teachers' success in integrating thinking skills into teaching will produce students capable of making decisions, enhancing achievement, and generating learning based on experience and knowledge.

The findings of Rifin et al. (2021) indicate that there is no significant difference between teachers with History education options and those without implementing HOTS in History teaching, with both groups showing high levels of competency. On the other hand, the study by Muzirah Musa and Wan Nur Atiqah Meor Samsudin (2021) found that Mathematics teachers in the Kerian district understand the concept of HOTS only at a satisfactory level and use Bloom's Taxonomy in their teaching, emphasising suitable methods in questioning and explaining topics. However, teachers face difficulties and lack confidence in developing routine questions, resulting in less satisfactory HOTS achievements in the learning process. This aligns with the study conducted by Bernard et al. (2021), which involved 10 teachers teaching in the Sebauh District, Bintulu, and found that the participants did not clearly understand HOTS. Additionally, this interpretive qualitative study revealed that teachers could not fully master the content of 21st-century learning (PAK-21). The researchers concluded that teachers must master the HOTS to enhance students' abilities to follow 21st-century learning.

Self-Efficacy

Self-efficacy refers to a teacher's confidence, beliefs, perceptions, and ability to organise and execute the necessary actions for success in the teaching and learning process. It also involves dealing with challenging situations and overcoming failure and stress (Bandura, 1977; Tschannen-Moran, 1998; Goddard, 2001). According to Bandura’s (1997) social cognitive theory, an individual's actions are influenced by their level of self-efficacy. Thus, teachers' sense of self-efficacy in teaching influences every decision they make in classroom practices (Goddard et al., 2004).

The study by Zee and Koomen (2016) demonstrated that self-efficacy not only influences teachers' teaching practices, classroom quality, and students' academic performance but also plays a significant role in teachers' psychological well-being by increasing job satisfaction and commitment while reducing stress and burnout. According to Putwain and Embse (2018), teachers with high levels of self-efficacy are less likely to feel stressed by curriculum changes and more tolerant of student misconduct. In the context of HOTS, teacher self-efficacy is a crucial aspect of education that affects how teachers implement effective teaching and learning strategies. The goal of Muhammad Ansori's (2019) study was to find out how well English teachers use critical thinking, interactive teaching methods, and metacognitive strategies to encourage HOTS in the learning process. The findings indicated that English teachers have confidence in using interactive pedagogical strategies, critical thinking, and metacognitive techniques. This study also provides initial

insights into the confidence levels of English teachers in using meaningful pedagogical techniques to promote HOTS in 21st-century classroom learning.

This aligns with the study by Dzul et al. (2021), which examined the relationship between beliefs, self-efficacy, and teaching in the context of Islamic Education subjects integrated with HOTS. The study sample included 642 Islamic Education teachers from 112 schools, using multilevel analysis to examine the effect of beliefs (group-level variable) on self-efficacy and HOTS-based teaching practices (individual-level variable). The study's findings showed a significant and positive relationship between beliefs and self-efficacy with HOTS teaching. Self-efficacy also acted as a mediator in this relationship. Overall, self-efficacy can influence teachers' behaviour in planning, selecting, and implementing effective teaching practices by integrating HOTS elements, thus positively impacting student performance.

Teachers' Knowledge of Higher-Order Thinking Skills (HOTS)

Teacher knowledge is a critical aspect of educational planning, where teachers with deep knowledge become more effective in their teaching (Bahr & Mellor, 2016; Jusoh & Osman, 2019). Mastery of knowledge enables teachers to deliver content efficiently, explain concepts confidently, and relate them to students' experiences. According to Ab Halim et al. (2021), sufficient knowledge and skills ensure that teachers remain relevant and can implement the curriculum effectively. Therefore, a teacher must possess comprehensive knowledge, including content knowledge, pedagogy, pedagogical content knowledge, curriculum, educational context, students, and educational philosophy (Shulman, 1987; Hamidon & Sishes, 2021). This knowledge is a key element in a teacher's teaching and learning process, where deep understanding ensures effective teaching delivery (Huling, 2014). The success of the education system depends on the knowledge and skills of the implementers, as misunderstandings can negatively impact students and stakeholders.

The study by Liu and Roehrig (2017) indicates that the improvement of HOTS among students depends on teachers' understanding of knowledge and skills in applying HOTS in teaching and learning sessions. Zohar (1999) also states that pedagogical knowledge related to HOTS is based on the types of knowledge introduced by Shulman (1987). According to a study titled The Competency of Science Teachers in Integrating Higher-Order Thinking Skills in Teaching and Learning conducted by Halim et al. (2021), involving 39 Science teachers in Besut, it was found that their knowledge about HOTS in teaching and learning is at a high level. This aligns with Mahmud's (2022) study, which shows that 61 primary school Mathematics teachers around Selangor are ready to apply the HOTS concept in their teaching and learning.

According to the study by Gunahlan and Ikhsan (2018), a significant number of teachers still lack mastery of the knowledge content related to HOTS. This results in low student achievement and difficulty in reaching the objectives outlined by the PPPM 2013-2025. However, the study by Pusparini et al. (2020) shows that teachers are still able to apply HOTS even though they have a limited understanding of the HOTS concept. These findings are consistent with those of Isnon et al. (2017), which indicate that teachers' knowledge of HOTS is moderate, but they exhibit a positive attitude towards its implementation. Moreover, this study shows a positive and significant relationship between teachers' knowledge level and the implementation of HOTS in the classroom (Abdullah et al., 2016; Abdul Latif et al., 2014;

Musa & Meor Samsudin, 2021). The contextual nature of HOTS teaching and learning approaches is also used in its implementation (Abdul Latif et al., 2014). These findings are consistent with teachers teaching Mathematics (Abdullah et al., 2016) and technical subjects (Radin Sharuddin & Mohamad, 2017). Abdullah et al. (2016) also found a positive and significant correlation between Mathematics teachers' knowledge level and their practices in implementing HOTS in teaching and learning. A strong correlation was found in curriculum and pedagogy aspects, while a weaker correlation was found in assessment aspects. These findings are also supported by the study of Radin Sharuddin and Mohamad (2017), which found a positive, significant, and moderate relationship between technical teachers' knowledge level and the implementation of HOTS elements in classroom teaching.

In conclusion, Abdullah & Darussalam (2018) emphasise that teachers need to have sufficient knowledge of teaching strategies and techniques to effectively implement HOTS in the teaching and learning process. Meanwhile, Baytelman et al. (2020) found that there is a relationship between teachers' knowledge and the quality of their delivery. Therefore, it is important to assess teachers' knowledge level in HOTS teaching and learning, as it affects their role and student success. Furthermore, the findings from the study by Nik Rozialnida et al. (2023), which involved six non-option primary school teachers teaching Science, used three data collection methods: interviews, observations, and reviewing support documents, namely the Rancangan Pengajaran Harian (RPH) of the participants. The study showed that the participants' knowledge of HOTS was limited, and they required information and courses related to HOTS to enhance their knowledge and understanding to fully implement HOTS in classroom learning.

Practice of Implementing HOTS

Application refers to the act of implementing or practising something in a teaching context. In this case, it refers to teachers' efforts to integrate HOTS into their teaching. HOTS thinking occurs once these principles are introduced in the learning process. The best way to implement it is to allow students to practice it, allowing them to think creatively and critically. According to Eggen (2000), this approach allows teachers to develop students' thinking methods without needing to explain the lesson content. The application of HOTS in teaching and learning also requires teachers to master the content thoroughly, as extensive and deep knowledge of a topic enables teachers to provide the information needed to think critically and creatively. However, according to Nursafra et al. (2016), a lack of information on the topic makes it difficult for teachers to connect ideas and apply critical and creative thinking. This is related to the study by Samsudin et al. (2020), which found that one of the main challenges in applying HOTS is the teachers' readiness to implement it. Even though most of the teachers have attended training or courses related to HOTS, they still face difficulties in fully understanding the concept, especially in formulating HOTS-orientated questions in assessments and classroom discussions.

Chin Mei Keong et al. (2021) conducted a study involving 51 trainee teachers from the PISMP program intake of June 2017 at IPG Kampus Ilmu Khas, Kuala Lumpur, who were in their eighth semester. The study found that, based on the perceptions of the eighth-semester trainee teachers, the lecturers at IPG Kampus Ilmu Khas, Kuala Lumpur, had effectively applied HOTS in their teaching and learning processes. All elements showed high mean scores, exceeding 4.00. Similarly, the study conducted by Rahmawati et al. (2021) found that the

Google Classroom and Edulogy applications could be used to effectively implement HOTS in teaching during the pandemic, involving 38 students from five primary schools.

The use of HOTS to teach KOMSAS by secondary school teachers in the Northeast District of Penang included 108 teachers of the Malay language. The mean score for teacher knowledge level before teaching and learning was 3.917, and the score during teaching and learning was 3.970. The teachers' attitudes towards HOTS in KOMSAS teaching and learning were high before teaching (M=3.894) and during teaching (M=3.875). The teachers' and students' problems with using HOTS in KOMSAS teaching and learning were moderate (M=3.116 and 2.578, respectively) (Nur Shahirah and Zamri, 2021). This phenomenon indicates that the level of knowledge, attitudes, and challenges faced by Malay language teachers affects the application of HOTS in KOMSAS, particularly among students during the teaching and learning process.

Bloom's Taxonomy Model

In 1956, the first model of Bloom's Taxonomy was introduced by Benjamin S. Bloom, considering the cognitive domain that consists of five levels of thinking: knowledge, application, analysis, synthesis, and evaluation (Bloom, 1956). Several changes have been made to Bloom's Taxonomy gradually in the hope that the efforts made by both figures will bring benefits in line with current developments and the 21st century. The Ministry of Education Malaysia has adopted Bloom's thinking pyramid in the national curriculum. Bloom's hierarchy explains that teachers need to apply it in teaching and learning to stimulate students' thinking in the classroom (KPM, 2018).

In 2001, Lorin Anderson introduced improvements to Bloom's Taxonomy to create more active educational objectives, specifically in the cognitive domain. The main changes involved replacing noun categories with verbs encompassing Low Order Thinking Skills (LOTS) and High Order Thinking Skills (HOTS). The use of verbs is more appropriate as it better explains the actions to be taken (Kamaruzaman, 2012). These improvements were published in his book titled A Taxonomy for Learning, Teaching, and Assessing (2001), co-authored with David R. Krathwohl, with the hierarchy of categories ranging from the lowest level to the highest level: remembering, understanding, applying, analysing, evaluating, and creating. These improvements align with current demands, where three changes made by Anderson to Bloom's Taxonomy are in terms of terminology, structure, and emphasis. However, in the context of this study, Bloom's Taxonomy theory is very relevant as it provides guidance in determining the level of HOTS that teachers need to incorporate in teaching and learning. With this approach, teaching and learning activities can be systematically planned, helping to enhance students' cognitive abilities in line with the demands of 21st-century education. The study by Tan et al. (2022) also highlights the importance of Bloom's Taxonomy in assisting teachers in planning activities that can challenge students' thinking to a higher level. Hence, these improvements to Bloom's Taxonomy have a significant impact on the formation of active and effective teaching and learning strategies in integrating HOTS more systematically and comprehensively.

Social Cognitive Theory

Social cognitive theory is a framework for understanding and predicting changes in human behaviour. This theory helps identify an individual's behaviour as a response to personal,

behavioural, and environmental factors (Bandura, 1997a; Bandura, 1997b). Wan Hanum and Jamal (2013) explain that the theory of self-efficacy for highly motivated behaviour refers to conscious cognitive operations involving the ability to predict goals and rewards, use judgement, evaluation, and decision-making. This theory also explains that an individual's level of confidence is closely related to their ability to perform a task (Bandura, 1997a). Four sources that can influence an individual's self-efficacy are mastery experience, vicarious experience, verbal persuasion, and low physiological arousal (Bandura, 1997b). The influence of self-efficacy expectations is considered a cognitive determinant, as shown in Figure 1. Therefore, this theory is seen as suitable for explaining the relationship between teachers' self-efficacy and the implementation of HOTS in teaching and learning in the classroom.

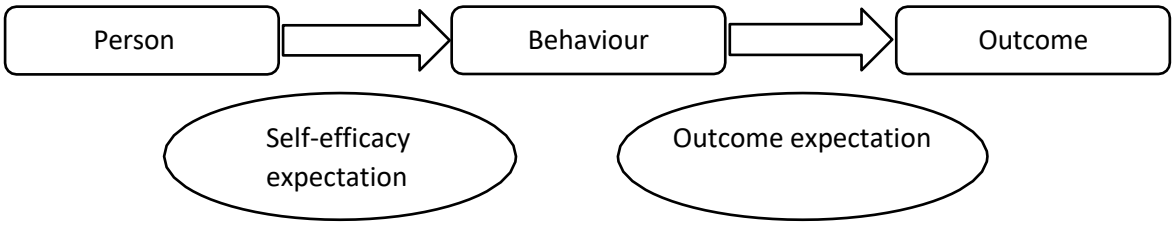

Figure 1: Influence of Self-Efficacy Expectations on Behaviour and Outcomes (Source: Bandura, 1977)

Conceptual Framework

This conceptual framework is built based on theories, models, and a review of previous studies. The variable chosen as a predictor in this study is self-efficacy as a mediator in the relationship between knowledge and the practice of implementing HOTS by teachers. HOTS knowledge is the independent variable, and the practice of implementing HOTS is the dependent variable.

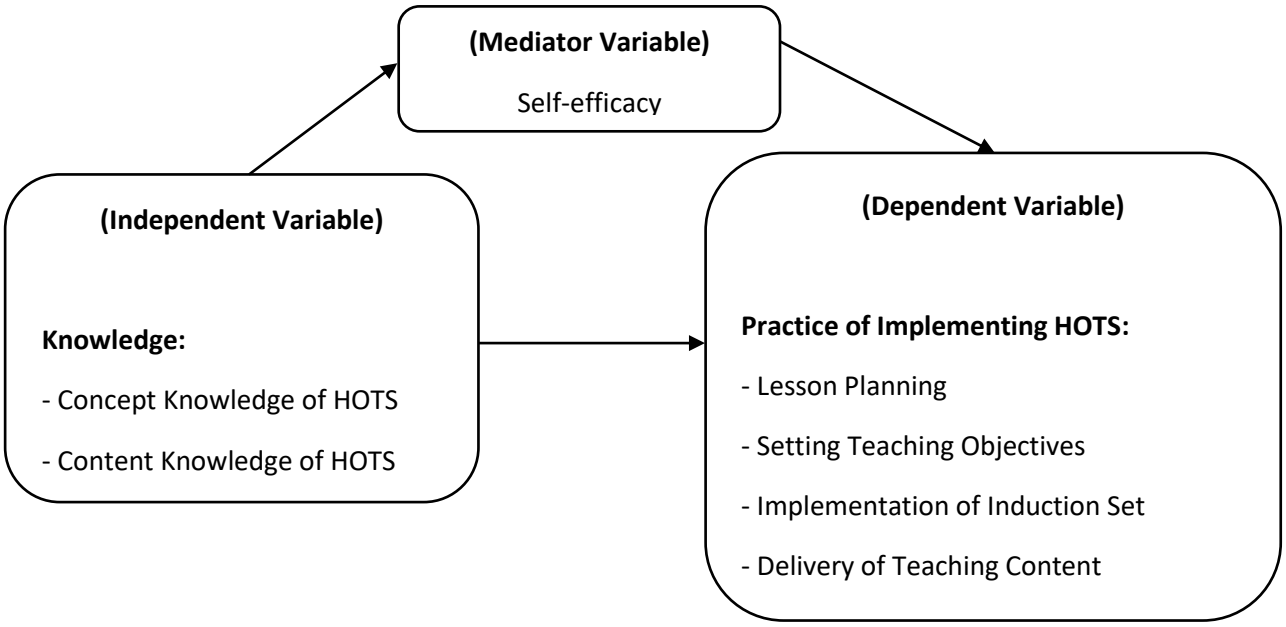

Figure 2: Self-Efficacy as a Mediator in the Relationship between Knowledge and the Practice of Implementing Higher-Order Thinking Skills (HOTS)

Methodology

Research Design

This study is quantitative research with a survey design. The researcher chose the survey design using a questionnaire instrument because the data can be collected only once, and it is more practical to provide sufficient information to study certain conditions. This is consistent with Creswell (2012), who states that researchers can gain strengths regarding the information on the relationship between variables through survey studies. Thus, the selection of the survey design aligns with the study's objective, which is to examine the relationship between knowledge, self-efficacy, and the practice of implementing HOTS among Home Science teachers in the central zone.

Population and Sample

This study involves the population of Home Science teachers in secondary schools within the central zone. According to data from the Selangor State Education Department (JPNS) and the Kuala Lumpur Federal Territory Education Department (JPWPKL), there are a total of 285 Home Science teachers. Therefore, the sample size of the study, according to Krejci and Morgan (1970), is 162 Home Science teachers to determine the number of sample sizes for the study. This study found that research on HOTS among Home Science teachers is still less conducted. The simple random sampling method was used in this study, where the sample was randomly selected from the 156 involved secondary schools. According to Cochran (1977), this method ensures that the sample selected is a fair representation of the overall population, thus increasing the reliability and validity of the study's findings.

Research Instrument

The study questionnaire was distributed via a Google Form link to the respondents. The use of questionnaire items is more practical as they can be managed by the researchers themselves (Creswell, 2022). The questionnaire is divided into four sections. Section A covers respondent demographics such as state of the school, gender, age, highest academic qualifications, and teaching experience. Section B contains 20 items adapted from the study by Mohd Zhaffar et al. (2021) to measure the dimensions of concept knowledge of HOTS, content knowledge of HOTS, pedagogical knowledge of HOTS, and knowledge about students among Home Science teachers. Next, Section C contains 10 items to measure teachers' self-efficacy in the implementation of HOTS in teaching and learning. The questionnaire items were adapted, modified, and translated from the General Self-Efficacy Scale (GSES) developed by Schwarzer and Jerusalem (1995) and adapted in the competency study by Ariff & Pyng (2024). Meanwhile, Section D uses 46 items to measure nine dimensions in the practice of implementing HOTS by Home Science teachers, namely dimensions of teaching planning, setting teaching objectives, implementing induction sets, delivering teaching content, implementing questioning methods, educational resources used, teaching reflection, summarising teaching content, and assessing understanding. The items in Section D were adapted and modified from the study by Mohd Zhaffar et al. (2021). The questionnaire items in Sections B, C, and D use a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

The modified questionnaire was referred to experts for review and validation of the study instrument's validity and reliability. The validity of this study involved three experts: a senior lecturer from the Faculty of Educational Studies at UPM, *Guru Cemerlang (GC) Sains*

Rumah Tangga, and *Guru Kanan (GK) Teknik dan Vokasional*. In addition to validation, a pilot study was also conducted to assess the reliability of the instrument and identify any weaknesses and confusion in the prepared questionnaire. Connelly (2008) recommends that 10% of the total actual study sample be selected for the pilot study. In terms of instrument reliability, Cronbach's Alpha reliability analysis for knowledge, practice of implementing HOTS, and self-efficacy among Home Science teachers in the central zone ranged from 0.88 to 0.94. The pilot study involved 30 Home Science teachers in Selangor and Kuala Lumpur to determine the instrument's reliability. According to Pallant (2010) and Fraenkel et al. (2012), a Cronbach's Alpha value exceeding 0.80 is considered good.

Data Analysis

Data were analysed using IBM SPSS version 29.0 software to obtain descriptive and inferential statistics. Descriptive statistical analysis was used to analyse the demographic characteristics of respondents and the main study variables, namely knowledge and the practice of implementing HOTS in teachers' teaching. Inferential statistical analysis was conducted using Pearson correlation tests (r) to measure the strength and direction of the relationship between the dependent and independent variables.

Meanwhile, to analyse the mediator variable, multiple regression analysis is used. According to Baron and Kenny (1986), mediation occurs when the effect in a model can be observed. Full mediation occurs when direct effects a and b are significant, but the direct effect c is not significant. On the other hand, partial mediation occurs if the direct impacts a and b are significant. However, the direct effect c is also important, as if the indirect effects a and b are not significant, this indicates that there is no effect on the mediator in the model. In conclusion, if this condition is met, no mediator exists.

Findings

Knowledge of Higher-Order Thinking Skills (HOTS)

Table 2 shows the mean scores and standard deviations to identify the level of knowledge in HOTS among Home Science teachers. The data analysis on knowledge indicates that the dimension of concept knowledge of HOTS recorded the highest score (M=4.52, SD=.450), followed by the dimension of content knowledge of HOTS (M=4.39, SD=.404). Next, the dimension of pedagogical knowledge of HOTS (M=4.21, SD=.408) and finally the dimension of knowledge about students (M=4.15, SD=.432). Overall, it shows that teachers' knowledge about HOTS is at a high level with a mean score value (M=4.29, SD=.339).

Table 2
Knowledge of HOTS based on dimensions

Dimension	Mean	Standard Deviation	Interpretation
Concept Knowledge of HOTS	4.52	.450	Excellence
Content Knowledge of HOTS	4.39	.404	Excellence
Pedagogical Knowledge of HOTS	4.21	.408	High
Knowledge about Students	4.15	.432	High
Knowledge	**4.29**	**.339**	**High**

Self-Efficacy

Table 3 shows the findings of the study on the level of self-efficacy of Home Science teachers, indicating that respondents obtained a high level of self-efficacy for the self-efficacy belief item, with a score of (M=4.13, SD=.395). This indicates that Home Science teachers have achieved a good level of self-efficacy.

Table 3
Self-efficacy based on items

Item No.	Mean	Standard Deviation	Interpretation
C1	4.56	.537	Excellence
C2	4.07	.699	High
C3	3.83	.762	High
C4	4.03	.548	High
C5	4.06	.552	High
C6	4.20	.399	High
C7	4.18	.510	High
C8	4.25	.466	High
C9	4.01	.591	High
C10	4.15	.528	High
Self-efficacy	**4.13**	**.395**	**High**

Practice of Implementing HOTS

Table 4 shows the findings of the study for the mean scores and standard deviations for each dimension of the practice of implementing HOTS. The dimension of delivering teaching content showed the highest mean (M=4.36, SD=.371), followed by the implementation of the induction set (M=4.28, SD=.442), summarising teaching content (M=4.27, SD=.385), setting teaching objectives (M=4.22, SD=.463), using educational resources (M=4.22, SD=.438), teaching planning (M=4.22, SD=.424), implementing questioning methods (M=4.22, SD=.403), assessing understanding (M=4.21, SD=.398), and lastly, teaching reflection (M=4.14, SD=.495). Overall, the practice of implementing HOTS is at a high level with a mean score value (M=4.27, SD=.327), particularly showing that Home Science teachers are very well-prepared in delivering lesson content during teaching and learning.

Table 4
Practice of Implementing HOTS Based on Items

Dimension	Mean	Standard Deviation	Interpretation
Lesson Planning	4.22	.424	High
Setting Teaching Objectives	4.22	.463	High
Implementation of Induction Set	4.28	.442	High
Delivery of Teaching Content	4.36	.371	Excellence
Implementation of Questioning Methods	4.22	.403	High
Educational Resources Used	4.22	.438	High
Teaching Reflection	4.22	.390	High
Summary of Teaching Content	4.28	.374	High
Assessment of Understanding	4.21	.398	High
Practice of Implementing	**4.27**	**.327**	High

Correlation Analysis

Table 5 shows the results of the Pearson correlation test analysis. There is a significant positive correlation, r = .632, and the p-value < .001. This data analysis indicates that there is a high relationship (r = .632) between knowledge and the practice of implementing HOTS among Home Science teachers.

Table 5
Relationship between Knowledge and the Practice of Implementing HOTS

Variables		Knowledge	Practice of Implementing
Knowledge	Pearson Correlation (r)	1	.632**
	Sig. (2-tailed)		<.001
	N	147	147
Practice of Implementing	Pearson Correlation (r)	.632**	1
	Sig. (2-tailed)	<.001	
	N	147	147

Multiple Regression Analysis

Table 6 shows the multiple regression analysis where self-efficacy acts as a partial mediator in this study. With a standardized regression of.398 (p <.005), this multiple regression analysis shows that there is a significant link between knowing about HOTS and putting it into practice. Additionally, the relationship between self-efficacy and HOTS knowledge is also significant, recording a standardized regression value of .335 (p < .005). Furthermore, the study of how to implement HOTS also found a strong link between HOTS knowledge and self-efficacy (.504), which is also a significant relationship (p <.005).

Table 6
Analysis using Multiple Regression

Analysis Result	Standardized Regression	B	Sig.
First Analysis (Overall effect) X = Knowledge Y = Practice of Implementing HOTS	.631	.608	< .001
Second Analysis (Direct effect) X = Knowledge M = Self-efficacy	.579	.674	< .001
Third Analysis (Direct effect)			
X & Y	.399	.384	< .001
M & Y	.400	.331	< .001

The results of the mediator test in Figure 1 have shown the indirect effect of knowledge on self-efficacy as .631 and the indirect effect of self-efficacy on teachers' practice of implementing HOTS as .579, with an indirect effect of .365.

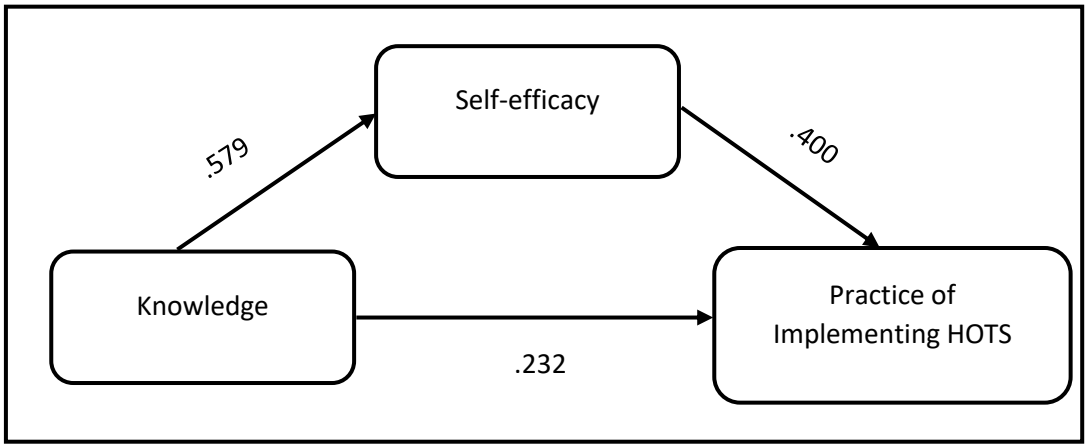

Figure 3: Procedure for analysis mediators in a complex model

According to Figure 3, the indirect effect is .632 x .579 = .365, whereas the direct effect is .232. The indirect effect is bigger than the direct effect in Figure 3. This means that the mediator variable is more important in explaining the link between knowing about HOTS and putting it into practice. Hence, the study findings conclude that the mediator effect exists (Rahin et al., 2023). Due to the significant direct and indirect effects, partial mediation is the type of mediation in this study. The study findings show that self-efficacy can mediate the relationship between knowledge and the practice of implementing HOTS. This result meets the requirements set by Baron and Kenny (1986), which say that the factor that acts as a mediator between the independent and dependent variables has a big impact on how the study results are analysed.

Discussion

The Level of Knowledge, Self-Efficacy, and Practice of Implementing HOTS among Home Science Teachers

Based on the findings of this study, it has been empirically found that the level of knowledge regarding HOTS among Home Science teachers in the central zone is generally high. This finding indicates that Home Science teachers have a thorough understanding of the concepts, principles, and applications of HOTS in teaching and learning. This finding is consistent with the study by Halim et al. (2021), which recorded a high level of knowledge, especially in aspects of teaching and learning. The study by Mahmud et al. (2022) also supports this finding, showing that teachers are ready to apply the concepts of HOTS in their teaching and learning. However, this finding differs from the study by Pusparini et al. (2020), which found that although some teachers have moderate knowledge, they can still implement HOTS effectively based on their positive attitudes. The study by Liu et al. (2017) emphasises that the improvement of HOTS among students greatly depends on the level of knowledge and skills of teachers in applying this concept during teaching and learning.

The highest dimensions of knowledge among Home Science teachers are concept knowledge and content knowledge of HOTS. The high level of knowledge among Home Science teachers reflects several positive factors, where most Home Science teachers involved in this study have more than five years of teaching experience and have attended various training related to the implementation of HOTS in teaching and learning. This

experience and training likely contribute significantly to the high level of knowledge. When teachers possess sufficient and in-depth knowledge about the use of HOTS-based teaching strategies and techniques, it ensures that HOTS teaching and learning can be effectively implemented for students. Therefore, it is important to examine the level of teachers' knowledge in HOTS teaching and learning. This affects the role of teachers in the classroom and the success of students in mastering HOTS. In this context, the findings of this study highlight the strengths of Home Science teachers, who may have a more comprehensive understanding of HOTS elements in their teaching and learning. These findings provide significant information to education policy implementers, such as the Malaysia Education Blueprint (PPPM) 2013-2025, which emphasises the importance of implementing HOTS in teaching. The high level of knowledge among Home Science teachers aligns with the efforts of the Ministry of Education Malaysia (KPM) to achieve HOTS objectives as a fundamental curriculum element. Additionally, this also supports the Digital Education Policy (2023) initiative, which encourages the integration of technology to empower HOTS in education.

Meanwhile, based on the findings of this study, it has been empirically found that the practice of implementing HOTS among Home Science teachers in the central zone is generally at a high level. The study findings show that the dimension of delivering teaching content is the highest compared to other dimensions. This dimension reflects the teachers' ability to deliver teaching content effectively and systematically. Additionally, the dimensions of summarising teaching content and implementing the induction set recorded high levels, indicating that teachers pay attention to the initial and final stages of the teaching session to ensure the continuity of learning. Previous studies support these findings, with Rahim et al. (2019) indicating that delivering teaching content plays a major role in fostering creative and critical thinking among students. Planned delivery methods, such as interactive discussions, can help students understand concepts deeply. Furthermore, the study by Ahmad & Sulaiman (2020) states that an engaging induction set can increase students' motivation to participate in HOTS-based learning in the classroom.

The high level of practice in implementing HOTS indicates teachers' readiness to use various teaching strategies in their teaching and learning that can encourage students to think critically. Additionally, this study shows that teachers are aware of the importance of planning their lessons in line with HOTS objectives and utilising various educational resources to enhance teaching effectiveness. Consequently, Home Science teachers working in urban areas may have greater access to modern educational resources, including the latest digital technology, and are also influenced by extensive experience and more efficient pedagogical knowledge throughout their service. This aligns with the study by Rahmawati et al. (2021), which shows that the practice of implementing HOTS in teaching can be effectively carried out using applications such as Google Classroom and Edulogy.

The implications of this study's findings underscore the need to provide continuous training for teachers, especially for those teaching Home Science, to improve aspects such as teachers' assessment of understanding in applying HOTS in their teaching and learning. Also, teachers in rural areas who teach Home Science should always be supported by giving them access to digital learning materials that can improve the way HOTS is used. This is in line with Sustainable Development Goal 4 (SDG 4), which aims to make sure that everyone gets a good education and encourages people to keep learning throughout their lives. The use of

technology in education is closely related to the integration of HOTS elements, as technological resources can enrich the learning experience and foster critical and creative thinking.

Furthermore, the findings of this study empirically show that the self-efficacy of Home Science teachers in the central zone is generally at a high level. This is an important aspect of education that influences how teachers implement effective teaching and learning strategies in the classroom. Bandura (1997) explains that a suitable environment can form self-efficacy, leading to appropriate behaviour. A positive environment can enhance self-efficacy through mastery experiences, observational experiences, psychological stimuli, and emotions. Muhammad Ansori's (2019) study found that teachers who have confidence in their abilities are more likely to use interactive and metacognitive pedagogical strategies to implement HOTS in their teaching. Similarly, the study by Dzul et al. (2021) noted that teachers' self-efficacy has a positive relationship with HOTS teaching. Teachers who believe in their abilities are more likely to implement effective and innovative teaching methods. Self-efficacy also plays a significant role in fostering meaningful pedagogical practices in line with 21st-century learning needs and HOTS implementation during teaching. Consistent with the study by Norzlina et al. (2020), teachers' self-efficacy directly influences their effectiveness in implementing HOTS. This aligns with the study's findings that show teachers believe they can efficiently handle unexpected challenges in teaching and learning. The level of self-efficacy is also influenced by the teachers' experience, where experienced teachers show higher confidence as they have mastered problem-solving strategies and possess stronger pedagogical skills. On the other hand, this may differ for new teachers, who may lack confidence in implementing HOTS elements in their teaching due to lack of experience. This indicates the need for intensive guidance and training for new teachers to help them build their self-confidence. The study's findings also align with the objectives of the Malaysia Education Blueprint (PPPM) 2013-2025, which focuses on teacher professionalism development and teaching effectiveness. PPPM emphasizes the importance of enhancing teachers' confidence in problem-solving and strengthening HOTS elements in the classroom. The Malaysia Teacher Standards (SGM) also require teachers to have a high level of self-efficacy to tackle complex challenges in the classroom and teaching and learning sessions.

The implications of this study's findings indicate that continuous training should be provided to teachers, especially in goal-setting and problem-solving strategies, to enhance their confidence to a higher level. Additionally, the school environment's support also plays a crucial role in creating a conducive work atmosphere and professional collaboration to help teachers build their self-confidence. Regular evaluations also help in assessing teachers' self-efficacy levels to identify weaknesses and plan appropriate interventions.

Relationship between Knowledge and Self-Efficacy with the Practice of Implementing HOTS among Home Science Teachers

The results of this study show a strong and significant relationship between knowledge and the practice of implementing HOTS among Home Science teachers in the central zone, as revealed in the Pearson correlation analysis. The higher the teachers' knowledge related to HOTS, the higher their practice of implementing HOTS in their teaching and learning. Teachers with high knowledge levels are more prepared to integrate HOTS elements in the classroom. Teachers who have deep and extensive knowledge in a particular field will be effective in

delivering their teaching content (Jusoh & Osman, 2019). This finding is supported by Ab Halim et al. (2021), which states that with clear and sufficient knowledge and skills, teachers can remain relevant and effectively implement the curriculum in the classroom. Highly knowledgeable teachers will succeed in implementing HOTS practices in the classroom and can plan more effective strategies to integrate HOTS elements in their teaching. Thus, it can be said that more knowledgeable teachers can plan, implement, and evaluate their teaching effectively and can enhance HOTS practice in the classroom. Consequently, teachers become more prepared to apply HOTS practices in each lesson, involving all students.

The Pearson correlation analysis of the study results shows that there is a strong and significant link between what Home Science teachers in the central zone know and how they use HOTS in their lessons. The higher the teachers' knowledge related to HOTS, the higher their practice of implementing HOTS in their teaching and learning. Teachers with high knowledge levels are more prepared to integrate HOTS elements in the classroom. Teachers who have deep and extensive knowledge in a particular field will be effective in delivering their teaching content (Jusoh & Osman, 2019). This finding is supported by Ab Halim et al. (2021), which states that with clear and sufficient knowledge and skills, teachers can remain relevant and effectively implement the curriculum in the classroom. Highly knowledgeable teachers will succeed in implementing HOTS practices in the classroom and can plan more effective strategies to integrate HOTS elements into their teaching. Therefore, we can assert that teachers with greater knowledge can effectively plan, implement, and evaluate their teaching, thereby enhancing the use of HOTS in the classroom. Consequently, teachers become more prepared to apply HOTS practices in each lesson, involving all students.

Furthermore, the results of the study also show that self-efficacy acts as a partial mediator in the relationship between knowledge and the practice of implementing HOTS, as analysed using multiple regression methods. It was found that knowledge has a direct effect on HOTS practice and a significant indirect effect through self-efficacy that is stronger than the direct effect. Teachers with high knowledge but low self-efficacy may be less confident in implementing HOTS. Conversely, teachers with high self-efficacy are more enthusiastic about applying their knowledge in the classroom. This indicates that self-efficacy plays a dominant role in explaining the relationship between knowledge and the practice of implementing HOTS. The study also shows that although knowledge is very important, each teacher's self-efficacy is also a catalyst for translating their knowledge into effective teaching practices. Teachers who believe in their capabilities are more likely to apply HOTS knowledge in their teaching, even when faced with pedagogical challenges. In line with the study by Putwain et al. (2018), teachers with high self-efficacy are less likely to feel stressed by curriculum changes.

In summary, the findings of this study demonstrate that teachers' knowledge and self-efficacy play a crucial role in implementing HOTS, where HOTS-based teaching not only enhances students' learning motivation but also depends on the level of teachers' knowledge and confidence in their abilities. Therefore, it is crucial for teachers to actively enhance their knowledge and self-efficacy, especially by mastering the concepts, principles, and strategies of HOTS, to ensure more effective teaching and motivate students to reach their maximum learning potential.

Conclusions and Recommendations

The findings of this study found a significant mediating role of self-efficacy in the relationship between practices and teacher knowledge in HOTS among Home Science teachers. Teachers with a high capability of HOTS can use those skills effectively in the classroom when they have high self-efficacy, as evidenced by the findings. It is certainly more likely that teachers will implement HOTS-based, similar strategies more creatively and efficiently in their teaching to increase student motivation and learning outcomes. On the other hand, the integration of HOTS into education practices faces challenges such as a lack of pedagogical content knowledge, heavy workloads, and varying levels of student engagement. Overcoming these barriers should be a priority when embedding HOTS in the learning process.

Considering the partial mediating effects identified in this study, self-efficacy deserves to be a key factor in educational policies and teacher training programs. Schools and education institutions must adopt practices that build teachers' confidence in HOTS, such as mentoring, peer working, and in-service training in HOTS-based pedagogy. Further studies will explore the long-term impact of self-efficacy on the implementation of HOTS across various subjects or levels of education. Teaching in an environment that focuses on both knowledge and confidence is the key to helping students develop critical thinking skills that are crucial to succeeding in the global world of the 21st century. This will help educators prepare teachers for what needs to be achieved in the context of facing up to the educational heritage of the Malaysian Education Plan 2013–2025, enhancing the quality of education in Malaysia, and promoting HOTS among students.

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